ADVISORY DEPARTMENT

OF

THE IMPERIAL COLLEGE OF

TROPICAL AGRICULTURE.

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5 DEC. 1938
INSTITUTE

REPORT

ON THE

AGRICULTURAL DEPARTMENT, ST. VINCENT,

FOR THE YEAR

1937.

[Price Sixpence.]

Annual Report

of the

Agricultural Department.

St. Vincent.

1937.

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1938.

LETTER OF TRANSMITTAL.

The Imperial College of Tropical Agriculture,
Agricultural Advisory Department,
Trinidad,
6th September, 1938.

C.A. 1079/38.

Sir,

I have the honour to submit herewith the annual report of the Agricultural Department for the year 1937.

2. There was an abnormal distribution of rainfall in the year, and both excessively wet conditions at one period and excessively dry conditions at another in some respects adversely affected crop production.

3. The total export value of agricultural products exported in 1937 amounted to £183,220, an increase of 21 per cent. over the corresponding amount for 1936. This increase was due to moderate increases in the export quantity and value of all the chief industries of the Colony.

4. The arrowroot industry maintained its position as the most important industry of the Colony. Although owing to severe leaf defoliation by the arrowroot caterpillar production did not reach the record crop of the previous year, there was a further increase in exports. As no appreciable increase in acreage of arrowroot is anticipated and as there are favourable prospects of continued annual increases in the quantity of starch exported, the position of the industry may be regarded as satisfactory.

5. The Sea Island cotton crop of 1937 was seriously affected by the abnormally heavy rains in January which caused much loss through shedding and rotting of the bolls. In spite of the large increase in acreage, 5,294 acres in 1936-37 as compared with 3,540 acres in the previous season, there was only a small increase in production, the yield per acre of lint falling to the low level of 79 lb. The low yield was however in some measure compensated for by the good price obtained for the bulk of the crop.

6. The Government cotton ginnery was successfully operated during the year; the staff was reorganised and several important mechanical and constructional improvements were effected. Peasants delivering cotton to the Government ginnery were paid at the very satisfactory rate of 9.33 cents per lb. of seed cotton, the total sum paid in this respect amounting to £8,019.

7. There was a decline in production of both sugar and syrup in 1937, but total export values of these products were considerably higher than in 1936 owing to the increased value of sugar and to the larger quantity of syrup exported.

8. As a result of the comparatively low prices obtained for St. Vincent syrup, efforts have been made to effect a better organisation of the industry. The Crop Specialist has endeavoured to standardise the method of manufacture and thereby produce a syrup of uniform quality. Satisfactory progress has been achieved in this direction. Moreover an attempt has been

made, in co-operation with producers in Barbados and St. Lucia to maintain a reasonable price level for syrup by restricting exports, and with this object in view an export quota system for the three producing Islands has been introduced.

9. The production of coconuts and copra during the year was a record for the industry. Further areas of recently established palms have reached maturity and increased production follows as a natural consequence. Copra prices were exceptionally remunerative during the early part of the year, but later declined to an unattractive level.

10. There was no further appreciable increase in the acreage under bananas in 1937, but production in the areas established in the previous year was greatly increased, the total quantity of fruit sold to the Canadian Banana Company amounting to 75,434 stems, or more than double the corresponding amount in 1936. The experience of the first few years of the industry has shown that marketable fruit of good quality can only be economically produced in the more humid and sheltered valleys of the Leeward District. It is greatly to be rgeretted that the existence of this newly established and useful industry should now be threatened by the outbreak of Cercospora leaf disease.

11. St. Vincent exports on a small scale a large variety of agricultural products and livestock other than the major products referred to in the preceding paragraphs. Collectively the value of the minor products and livestock amounted in 1937 to £16,442 or 9 per cent. of the total export value of agricultural products.

12. A useful record of the experimental work of the Department is presented in the report and deserves the careful attention of planters. As a result of manurial experiments the need for the application of nitrogenous manures to the soils of St. Vincent has been confirmed, and as a means of economically controlling the arrowroot leaf defoliator spraying with colloidal lead arsenate has been demonstrated.

13. The recent attention which has been paid to soil erosion in some parts of the Empire renders conspicuous the absence in this report of any reference to soil conservation work, especially as soil erosion presents so serious a problem in St. Vincent. Preliminary investigations are however being undertaken in this connection, but it is important that the Agricultural Department should be provided with the necessary facilities on an adequate scale for fully investigating the problem and demonstrating in due course the most suitable means of ensuring soil conservation under the conditions of St. Vincent.

14. It is noted with satisfaction that provision is being made for the appointment of agricultural instructors whose activities will be mainly confined to the education of the peasantry in all matters relating to agriculture and marketing.

15. An account of the progress of the land settlement scheme initiated in 1933 at the Three Rivers estate is included in the report. The settlers require more careful supervision and direction than they have received in the past in order to ensure success of the scheme. The small arrowroot and syrup factories on the settlement are in urgent need of renovation if they are to serve any further useful purpose.

16. At the end of the year Mr. A. K. Briant, Agricultural Superintendent since July 1934, was transferred on promotion to Zanzibar. Mr. Briant accomplished much useful work during his short period of service in St. Vincent. There was a very marked improvement in the standard of agricultural production and factory efficiency in the Colony during his term of office and the operation of the Government cotton ginnery was successfully reorganised under his direction.

I have the honour to be,
Sir,
Your obedient servant,

C. C. SKEETE,
Acting Commissioner of Agriculture.

His Honour,
The Administrator,
St. Vincent, B.W.I.

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Staff of the Agricultural Department

Agricultural Superintendent ..	A. K. Briant, M.A., Dip. Ag., (Cantab). A.I.C.T.A.
Agricultural Assistant ..	C. K. Robinson, D.I.C.T.A.
Crop Specialist (Sugar) ..	C. C. Seale, D.I.C.T.A.
Instructor for Banana Industry ..	G. Fraser.
Field Assistant	L. Brown.
Foreman, Botanic and Experiment Stations	R. Vanloo.
Clerical Assistant	Miss S. E. R. Anderson.
Laboratory Assistant to Cotton Research Officer ..	Miss N. Grant.
Clerical Assistant to Cotton Research Officer ..	Miss H. W. Deane.
Cadet	C. George.
Banana Field Assistants ..	A. Brown and P. Bruney.

COTTON RESEARCH STATION.

(Provided by the Empire Cotton Growing Corporation).

Cotton Research Officer ..	S. H. Evelyn, D.I.C.T.A.

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REPORT ON THE AGRICULTURAL DEPARTMENT, ST. VINCENT.

FOR THE YEAR ENDED 31ST DECEMBER, 1937.

SECTION I.

Weather Conditions.

Weather conditions were rather unusual during the year 1937 and, although the term abnormal may have little or no real meaning when applied to weather, conditions during the year were in many respects very exceptional. The rainfall in January was very high and, in fact, is the highest on record for this month: the total recorded at the Botanic Gardens being 16.58 inches as compared with 6.27 inches, the average for the past 43 years. Towards the end of January, however, the high rainfall ceased and a period of very dry weather set in which did not break before early June. During the period February to May the total rainfall recorded at the Botanic Gardens was only 7.75 ins., and the total for May, 0.92 ins., was the lowest on record. Although the drought broke in June the rainfall for the rest of the year was low and much below the average, the total being only 51.49 ins., whereas the average for the past 43 years is 76.88 ins. During the latter part of the year the rainfall was fairly uniformly distributed, except in the months of September and October when for short periods conditions were unusually dry.

The total rainfall for 1937, as recorded at the Botanic Gardens was only 75.82 ins. which compares very unfavourably with the average for the past 43 years: 101.96 ins. Rain fell on 252 days at the Botanic Gardens and on 231 days at the Experiment Station.

Tables of meteorological observations are given as Appendix I to this Report.

General.

The recovery of agricultural industries from the effects of the depression noted in the Report for 1936, was steadily maintained and the outlook at the end of 1937 was generally favourable. The value of the principal exports, £168,261, showed an increase of £26,209 over that for 1936, and similarly the value of the imports £122,176, increased by £19,546, and the balance of trade in favour of the Colony (for the principal exports and imports) was £46,085. There were substantial increases in the value of the exports of Sea Island cotton, copra, rum, bananas and arrowroot starch, indeed the exports of arrowroot starch, 8,073,117 lb. valued at £90,311, constitute a record for this industry. A decrease was recorded in the exports of coconuts, but this was due chiefly to the increase in the price of copra and was amply compensated for by the increase in exports of the latter.

The chief exports with their export values for the Colony during the past three years are shown in Table I.

TABLE I.

		Quantities Exported.			Values		
		1935.	1936.	1937.	1935. £	1936. £	1937. £
Arrowroot Starch	lb.	6,609,856	6,974,962	8,073,117	76,668	80,419	90,311
Sugar	tons.	725	500	500	6,406	3,961	5,250
Syrup and Molasses	gals.	148,357	163,720	242,690	6,182	7,900	10,523
Rum, proof	gals.	5,468	5,497	9,414.4	641	731	1,331
Cotton, Sea Island	lb.	205,459	395,598	418,607	9,947	28,972	34,059
Cotton, Marie Galante	lb.	38,604	68,235	52,633	804	1,707	1,483
Copra	lb.	840,602	787,765	1,845,331	3,418	4,831	13,518
Coconuts	No.	3,391,582	5,795,190	1,671,470	10,215	8,969	5,332
Cocoa	lb.	97,242	27,782	50,156	915	235	843
Bananas	stems.	5,837	35,598	65,177	475	2,663	4,971
Cassava Starch	lb.	778,059	531,944	370,885	4,124	2,395	1,932
Groundnuts	lb.	15,282	575	300	98	2	2
Nutmegs	lb.	30,240	26,220	45,826	378	375	751
Mace	lb.	6,796	4,805	9,400	283	256	587
Maize	lb.	4,261	5,368	65,194	25	22	161
Peas	lb.	100,872	51,357	36,312	624	313	218
Limes	No.	695,570	513,398	554,712	166	154	147
Plantains	stems.	—	—	—	295	210	301
Sweet Potatoes	bags (120 lb.)	9,150	3,411	4,860	2,294	1,096	1,458
Yams	lb.	—	—	—	168	124	136
Tannias	lb.	—	—	—	477	287	332
Cattle	No.	22	34	61	135	137	280
Goats	No.	2,114	2,110	3,222	758	808	1,408
Poultry	No.	—	—	—	687	858	1,792
Pigs	No.	2,390	2,127	2,676	3,954	3,843	4,871
Sheep	No.	958	814	1,160	485	429	680
Asses	No.	45	81	225	85	110	338
Horses	No.	2	11	10	55	214	205
Total					130,762	152,021	183,220

Arrowroot Industry.

Production. The production of starch during the crop year 1st October, 1936 to 30th September, 1937, amounted to 33,131 barrels of 224 lb. each, which was rather less than the record crop of 34,444 barrels produced in 1935-36. The decrease in production was largely due to the severe weather of 1936 and to one of the worst attacks of the arrowroot caterpillar (**Calpodes ethlius**) experienced in St. Vincent, as mentioned in the Report for 1936, so that the yield of starch per acre, as well as the yield of rhizomes were consequently low. The weather in 1937 was in general very favourable for digging the crop and extraction of the starch and quality was well maintained; during the wet spell in December 1936 and January 1937, however, the drying of starch was considerably delayed and the grade of such starch suffered. In Table II is shown the quantity of starch produced in the various grades by estates and by peasants.

TABLE II.

Grade.	*Estates.*	*Peasants.*	*Total.*
1	23,968	—	23,968
2	2,420,084	567,852	2,987,936
3	1,736,075	543,909	2,279,984
4	1,051,103	599,329	1,650,432
5	201,233	253,793	455,056
Ungraded	23,005	1,019	24,024
Total	5,455,498	1,965,902	7,421,400

Table II shows that 73.5% or nearly three-quarters of the total output was produced by estates and only 26.5% by peasants. Included in the estates' production, however, is a proportion of starch retained by estates in payment for the extraction of starch from rhizomes grown by peasants, the quantity so retained being usually one-quarter of the total quantity of starch obtained. It is estimated that if this quantity of peasant grown starch were included in the peasants' total, the peasant production would be increased to approximately 30% and estate production would be correspondingly decreased. This procedure whereby starch from peasant grown arrowroot is extracted in an estate factory usually results in the production of a higher grade of starch than if the peasant extracted the starch with the rather primitive means at his disposal.

Exports. The quantity of starch exported in 1937 totalled 8,073,117 lb. and is the highest on record, being 1,098,155 lb. greater than the quantity exported in 1936, the largest previously recorded. The total exports and values for the past five years are given in Table III.

TABLE III.

Year.	*Arrowroot* lb.	*Value* £	*Cassava* lb.	*Value* £
1933	4,589,435	55,510	681,761	3,110
1934	6,526,003	75,044	480,587	3,081
1935	6,609,856	76,668	778,059	4,124
1936	6,974,962	80,419	531,944	2,395
1937	8,073,117	90,311	370,885	1,932

The destination of starch exported during the past five years is shown in Table IV. The chief exports were to the United States of America, and showed a further increase of over three-quarters of a million pounds. There were also slight increases in the exports to the United Kingdom and Canada and there were indications that a greater interest is being taken in this product in the intercolonial markets.

TABLE IV.

	1933 *lb.*	1934 *lb.*	1935 *lb.*	1936 *lb.*	1937 *lb.*
United Kingdom	1,523,663	1,794,125	1,764,186	1,892,912	1,900,000
U.S. America	2,455,858	3,534,071	3,954,400	4,231,580	5,025,500
France	230,160	142,410	212,800	193,736	190,120
Canada	193,557	370,838	404,064	431,640	468,564
Barbados	8,492	98,748	15,348	8,202	21,486
Germany	78,314	63,628	87,264	75,056	118,720
Trinidad	6,720	384,188	61,291	61,980	259,859
Holland	51,520	36,739	57,120	48,864	48,000
Antigua	5,835	15,024	19,926	7,920	14,400
Jamaica	12,000	2,400	7,200	2,400	2,400
British Guiana	—	52,720	19,309	8,560	15,088
Other Countries	22,816	31,112	6,948	12,112	8,980

Stocks have also shown a decline and on 30th September, 1937, were nearly 3,000 barrels less than on the same date in 1936.

The prospects of the industry are, therefore, very favourable and there is every indication that the steady increase in exports of the last few years, notably to the United Kingdom and the United States of America will be maintained in 1938.

1937-38 Crop. The area under arrowroot for the 1937-38 season is estimated to be about 3,850 acres, showing an increase of approximately 100 acres. This increase has occurred chiefly on estates which have changed management recently and it is not anticipated that there will be any further increase to any extent in the near future.

The 1937-38 crop was subject to adverse weather conditions, the prolonged dry season of 1937 caused marked retardation of growth, and fields dug late in 1936 suffered particularly; also in many of the fields dug in the dry weather germination was poor and the stands were uneven so that considerable supplying was necessary. The dry weather, however, seemed to have had the effect of conserving the fertility of the soil, possibly because of the accumulation of nitrates, and with the advent of the rains which were unusually light and well distributed, all fields made good progress and even the very early fields which had commenced drying down, indicating approaching maturity, took on a new lease of life. In the latter case this vigorous growth late in the life of the plants which had previously not made satisfactory progress, resulted in a crop with a high percentage of immature rhizomes and starch yields were consequently very disappointing. The later fields, however, which would have a longer period for maturation should produce quite fair yields, except in those cases which had suffered serious defoliation by the arrowroot leaf roller, or in which supplying had been inadequate.

Arrowroot Worm. The populations of the arrowroot leaf roller (**Calpodes ethlius**) increased rapidly during the month of September and some damage was done, especially on the Leeward coast at Barrouallie and Cumberland where some fields were completely defoliated. Parasite incidence was low and the pest spread rapidly so that by the end of October fields throughout the island were attacked and more or less severely damaged. Thereafter the populations decreased and though the pest was to be found in fields at the end of the year, little further damage was done. The losses occasioned by this pest were not as great as in 1936, chiefly because of the lateness of the attacks at a period when a large part of the arrowroot had already begun drying down. The low incidence of parasites, except at the very end of the attacks seemed to have been due to the comparatively dry weather and it seems likely that the parasites in general require greater humidity than the pest. Experiments on the control of the pest by spraying with lead arsenate were very successful and it was demonstrated that an attack could be effectively controlled at a moderate cost. (Further details are given in Section II).

Manurial Trials. The studies on the manurial response of the arrowroot crop on the various soil types were continued. The results on the different soils are very interesting and an effort is being made to correlate the field result with analytical data of the soils supplied by the Department of Chemistry and Soil Science of the Imperial College of Tropical Agriculture. Further details of these experiments are given in Section II. The ultimate aim of this work is the estimation of the manurial requirements of the soils from a study of the content of the important plant nutrients as determined by simple and rapid chemical or other methods.

Cotton Industry.

SEA ISLAND.

1936-37 Crop. As pointed out in the 1936 Report, the 1936-37 crop, after a relatively poor start, made considerably improved growth with the more favourable weather conditions later in the year, though there was a tendency towards early maturity in December. The exceptionally wet weather in January coincided with the maturation of the crop, and there were considerable losses from shedding and from boll rotting induced by external boll disease.

Pests. Cotton stainers were not very numerous and little damage was done by this pest. The incidence of pink boll worm, however, was higher than usual and in some areas losses from the depredations of the pest were high. Due to the early maturity of the crop many growers had entertained hopes of a second picking, but the infestation of the late bolls with pink boll worm was so heavy that such hopes were abandoned and plants were pulled up shortly after the picking of the main crop.

Production. The crop was early and on the whole short, being practically all picked by the end of March. The total production was 417,818 lb. or approximately 1,044 bales of 400 lb. each, of which 906 bales were white and 138 bales were stained. The total area under cotton was 5,294 acres. The average yield was decidedly low, being only 78.9 lb. of lint per acre and the percentage stained (15.3) was somewhat higher than the average.

Exports. According to the Customs' returns 418,607 lb. of lint were exported, of which 361,401 lb. were white valued at £32,629 and 57,206 lb. were stained, valued at £1,430. The French market continued to show interest in this product, 59,792 lb. of white being shipped to this destination and the remainder to England.

Prices obtained during the year were excellent and to a large measure compensated for the low yields. A fair proportion of the crop was sold at 24d. c.i.f. Liverpool after which there was a tendency for the buyers to hold off and most of the remainder was sold at 23d. Lint for the French market was purchased locally on an f.o.b. basis at an average price of 20d. per lb. Table V shows the exports of lint for the past five years and in Table VI are given the statistics for the crop for a similar period.

TABLE V.

Year.	Export of Lint. lb.	Value £.
1933	160,792	8,107
1934	204,519	9,346
1935	205,549	9,947
1936	395,598	28,972
1937	418,607	34,059

TABLE VI.

Crops.	Areas planted acres.	Weight of lint lb.	Weight of lint per acre lb.	Percent stained to white.
1933-34 ..	1,216	99,750	82	14.76
1934-35 ..	1,464	173,735	119	18.92
1935-36 ..	3,540	396,960	112	11.03
1936-37 ..	5,294	417,818	78.9	15.03
1937-38 ..	4,900	—	—	—

Close Season. The Close Season for 1937 was from May 1st to August 15th. In 1936 the Close Season was from May 1st to July 31st, but there was reason to believe that this was probably too short a period and a Close Season of three and one-half or preferably four months is more desirable. A Close Season of four months, commencing on 1st May, would have the effect of forcing sowing into October anl experience has shown that this is not very satisfactory. A Close Season from May 1st to August 15th appears, therefore, to be the most suitable compromise under St. Vincent conditions.

1937-38 Crop. Weather conditions during the planting season, 15th August to 30th September, were very unfavourable, and though germination was on the whole very fair, the young seedlings suffered from the dry weather and considerable supplying was necessary. This was particularly so in the north Leeward districts where certain fields had to be practically replanted several times and even then the stands obtained were comparatively poor.

Area. The total area planted was 4,900 acres comprised of 2,675 acres cultivated by peasants and 2,225 acres by estates. This represents a reduction in acreage of 394 acres as compared with the 1936-37 crop, and was due entirely to a reduction in the area planted by peasants, the number of peasants being 592 less than in the previous year. The detailed figures are given in Table VII.

TABLE VII.

		Sea Island.	Acres.	Acres.
2,810	Peasants	St. Vincent	2,609	
160	„	Bequia	42	
19	„	Battawia	24	2,675
2,989				
27	Large Growers	St. Vincent	2,129	
3	„ „	Grenadines	96	2,225
30				4,900

There was a marked reduction in the incidence of angular leaf spot and other diseases due to **Bacterium malvacearum** as compared with early growth in 1936, and this may perhaps in large measure be attributed to the resumption of the mercuric chloride treatment of planting seed which was omitted in 1936.

In spite of the relatively dry weather the crop showed exceptionally good growth and it was evident by the end of the year that production per acre would be above the average. As in the case of arrowroot it would appear that the dry weather favoured the accumulation of nitrogen in the soil which was not leached out before the plants could utilise it as usually happens with the heavy rains in July and August.

The earliest fields began ripening off in December and cotton was being picked by the end of the year. The quality of lint was very good and the quantity of stained lint was very low.

Pests. Certain fields at the south of the island were attacked by the cotton worm (**Alabama argillacea**) in November and December. Normally, the cotton season is too late in St. Vincent for this pest but apparently the relatively dry weather favoured its breeding to a much later date than usual. About 150 acres of cotton were more or less completely defoliated but in general the pest was kept under control either by dusting with Paris Green or spraying with lead arsenate.

The incidence of cotton stainers was very low and no appreciable damage was done by the very small numbers occurring more or less sporadically in the north Windward districts.

The incidence of pink bollworm was also low and the pest could hardly be found in the field at the end of the year, except in the case of a few early maturing peasant patches in the Arnos Vale area. The available evidence now seems to support Mr. Squire's findings that early outbreaks of pink bollworm in St. Vincent are in some way connected with the peasant industry and are not in general due to carry-over in the field. A summary of the results of certain aspects of the investigations undertaken by Mr. Squire, who was appointed to study the possibilities of the control of pests of Sea Island cotton with the aid of funds provided by the West Indian Sea Island Cotton Association and the Colonial Development Fund, is given in Section II.

Varietal Trials. Two combined varietal and manurial trials were laid down in 1937. These experiments which were similar to those conducted in 1936-37 were designed to compare the yield of the standard V135 strain grown in St. Vincent with the Montserrat type of Sea Island cotton under a fairly wide range of manurial treatments. The results of the 1936-37 experiments indicated that the Montserrat strain is a heavier yielder of lint chiefly by virtue of its higher ginning percentage. The experiments are being continued for at least three years in order to determine whether the superiority of the Montserrat strain will be maintained under different climatic conditions and if possible to assess the financial value of the difference. The details of the 1936-37 experiments are given in Section II.

Marie Galante.

It was estimated that the area under cultivation for the production of Marie Galante cotton in the St. Vincent southern Grenadines totalled 745½ acres. The exports of lint in 1937 amounted to 52,633 lb. valued at £1,483. Prices during the early part of the year were fair, averaging 8¼d. per lb., but later slumped, probably as a result of the general business recession and averaged only 7½d. per lb.

The acreage returns for the 1937-38 crop are given in Table VIII.

TABLE VIII.

			Acres.	*Acres.*
153	Peasants	Union Island	465½	
37	„	Canouan	73¼	538¾
190				
2	Large Growers			180
				718¾

The crop in all the islands was seriously attacked by the cotton worm (**Alabama argillacea**) but recovery from the defoliation was excellent. The crop is making good progress and yields promise to be good except in the island of Mayreau where cotton on the hillsides has died out chiefly as a result of the drought in 1937.

Sugar and Syrup Industries.

A. SUGAR.

Area. During the 1936-37 season there were approximately 1,380 acres under sugar-cane in St. Vincent which represented a decrease of over 500 acres under this crop as compared with 1936. Of the total acreage about 670 acres, approximately the same as in 1936, were cultivated for the production of sugar and rum, and the reduction in acreage was practically confined to canes grown for the manufacture of syrup.

Production. Sugar production in 1937 amounted to 1,278 tons, of which 1,218 tons were dark crystals manufactured at Mt. Bentinck Estate, and the remainder, 60 tons, was muscovado sugar produced at Argyle Estate during a temporary local shortage early in the year. In addition 32,548 gallons of rum were distilled at Mt. Bentinck Estate.

Exports. Exports of sugar in 1937 totalled 500 tons of dark crystals, valued at £5,250, to the United Kingdom, so that the total quantity of sugar available for local consumption was only about 700 tons and proved to be insufficient and consequently sugar was later imported into the Colony. Exports of sugar and rum and their values for the past five years are given in Table IX.

TABLE IX.

Year.	*Sugar Tons.*	*Value £.*	*Galls. Rum (Proof).*	*Value £.*
1933	850	8,162	9,832	1,475
1934	750	5,979	5,761	908
1935	725	6,406	5,468	641
1936	500	3,961	5,497	731
1937	500	5,250	9,414	1,331

General Remarks. As mentioned above, the production of sugar in 1937 was inadequate to meet local demands as well as to utilise the export quota of 500 tons allocated to the Colony. Such a relatively low output was below the optimum and must inevitably result in an increased cost of production. It is, therefore, urgently necessary that some determined effort be made to increase production to a figure commensurate with local demands and export quota; the industry is of considerable economic value to that section of the Colony and perhaps it may be made of even greater value both to the producer and to the peasantry by instituting some well organised system of cane farming to augment the supplies of cane to the factory.

1937-38. Crop. Area. The acreage under cultivation for the production of sugar in 1937-38 was approximately 650 acres. The canes were adversely affected by the severe dry weather and it is estimated that production is not likely to exceed 1,450 tons.

B. SYRUP OR FANCY MOLASSES

Area. There was a considerable reduction in the area under sugar cane for the production of syrup in 1937 amounting to approximately 43% as compared with 1936 and the total acreage was estimated to be about 715 acres. During recent years interest in this industry has markedly declined chiefly as a result of unremunerative prices and consequent accumulation of stocks.

Production. The average yield of cane was estimated to be about 15 tons per acre and the average yield of syrup obtained at ten factories was approximately 284 gallons per acre. The total production of syrup in 1937 was estimated to be about 194,800 gallons.

General Remarks. The quality of the syrup manufactured showed further improvement and Mr. J. G. Davies, Sugar Technologist of the Imperial College of Tropical Agriculture reported in June 1937 that the quality of samples of St. Vincent syrup which he had examined at least equalled the Standard "Bema" brand of Barbados. There was still some variation however, and the buyers of St. Vincent syrup are of the opinion that the marketing of this product cannot be placed on a really satisfactory basis until uniformity in the quality is assured. The first stage in the establishment of uniform quality is the standardisation of the method of manufacture and this is to an increasingly large measure being achieved in practically all the larger factories. (Further details are given in Section II by Mr. C. C. Seale, Crop Specialist, in charge of this work). The second stage, namely, large scale blending of the output of the various factories, presents greater difficulties but is also perhaps an even greater essential for the successful marketing of the product. All producers are now agreed on the necessity for blending but there are great practical difficulties in the way of reconciling conflicting interests and it is unlikely that complete blending of the total output will be established in the near future. A scheme has been proposed, however, which will be put into operation in 1938 whereby a fairly large proportion of the crop will be blended and sold through one organisation. This should go a long way towards establishing some degree of stability in the marketing of St. Vincent syrup.

Another factor which should tend to effect some improvement in the syrup market as a whole is the agreement recently negotiated by the various producing islands of the British West Indies to limit the annual production of syrup. Under this agreement St. Vincent has been granted an export quota of 6,000 barrels for the period 1st December, 1937, to 30th November, 1938. This quota has been satisfactorily allocated to the local producers and in addition legislation is in contemplation whereby syrup manufactured during this period for export will be subject to a grading scheme including the issuing of Government certificates and syrups failing to attain the defined standards would be exported as ungraded.

Exports. The exports of syrup in 1937 amounted to 242,690 gallons valued at £10,523 and local consumption was estimated to be about 30,000 gallons. Stocks of syrup in St. Vincent at the end of 1937 were estimated to be about 213,000 gallons, showing an appreciable decrease on the stocks at the end of the previous year. The exports of sugar and syrup and their values for the past five years are given in Table X.

TABLE X.

Year.	*Syrup Gallons.*	*Exports Calculated as tons sugar.*	*Value £.*
1933	278,528	928	11,624
1934	269,233	897	11,218
1935	148,357	494	6,182
1936	163,720	546	7,900
1937	242,690	809	10,523

Manurial Trials. During the year one manurial experiment laid down under the supervision of Mr. Seale, on plant canes in 1936, was reaped. The results which are given in greater detail in Section II, tend to indicate that under the conditions of the experiment, deficiency of nitrogen is one of the most important factors limiting yield. When these results are considered in conjunction with those of arrowroot and cotton experiments, it would seem reasonably safe to generalise and recommend a fairly heavy application of nitrogenous manure (equivalent to 300 cwt. of sulphate of ammonia) to canes under conditions in which unsatisfactory moisture relationship is not the limiting factor.

Moth Borers. Observations in 1937 showed that there was an appreciable increase in the incidence of the small moth borers (**Diatraea spp.**) which are the most important pests of sugar cane in St. Vincent. The average joint infestation was 19.4% as compared with 11.01% in 1936. The data, which were compiled by Mr. Seale, are given in detail in Section II.

1937-38 Crop. Area. It is estimated that approximately 740 acres of canes are under cultivation for the production of syrup in 1938. The canes have suffered considerably from the extended dry season of 1937 and plant canes, particularly, made poor growth. With the increasing rainfall towards the end of the year some improvement was noted but it is anticipated that yields will be low and it is estimated that total production will be about 230,000 gallons.

Coconut Industry.

Production. The area under coconuts did not vary during the year and it is estimated that approximately 5,300 acres are under this crop. Production showed a considerable increase as compared with the 1936 crop and was slightly greater than production in 1935, which was the highest on record previously. Although total production was greater than in 1935, average production per acre was not as great as in that record year and the greater total production is probably due to the larger area now in full bearing.

The steady increase in price of copra towards the end of 1936 continued in 1937 and the price touched £25 per ton c.i.f. London early in the year. Thereafter, the price declined and remained around £20 per ton for the first half of the year. In the last six months prices declined further and did not average better than £16 per ton with poor demand and dull trading. The price of whole nuts did not vary appreciably during the year and was fixed by contract at $16.00 to $18.00 per 1,000 f.o.b. St. Vincent.

Under the circumstances a large proportion of the nuts obtained from the heaviest picking in the first half of the year was converted into copra but later with the decrease in price of copra this tendency was markedly reduced.

Exports. The quantities and values of coconuts and copra exported during the past five years are given in Table XI. The quantity and the value of the combined exports constitute a record for the industry.

TABLE XI.

Year.	*Coconuts.*		*Copra.*		*Total Value £.*	*Total exports calculated as Tons Copra.**
	Number	*Value £.*	*Tons.*	*Value £.*		
1933	17,713	38	960	8,978	9,016	964
1934	979,988	2,538	900	6,551	9,089	1,118
1935	3,391,582	10,215	375	3,418	13,633	1,129
1936	2,795,190	8,969	352	4.831	13,800	973
1937	1,671,470	5,332	824	13,518	18,850	1,195

* Note — The combined total is obtained by assuming 4,500 nuts are equivalent to one ton of copra.

Cassava Industry.

Owing to unremunerative prices and to the flourishing state of the arrowroot and cotton industries, practically no attention was devoted to this crop during the period under review and the acreage under cultivation suffered a further decrease. In consequence the exports of cassava starch amounted to only 370,885 lb. valued at £1,932, and part of the exports represented stocks held over from previous years.

It is unlikely that production of cassava starch will be materially increased in the future unless prices show a decided advance. Another factor which may have an important bearing on the cassava industry in St. Vincent, is that the Arrowroot Association is making efforts to substitute low grade arrowroot starch for cassava starch in the intercolonial markets, which at present are the most important markets for cassava starch.

During the year one or two enquiries originating chiefly from Canada were received with regard to this commodity but invariably the prices offered were too low to attract local producers.

Banana Industry.

Area. It was estimated that the area under bananas at the end of 1937 was about 1,100 or slightly greater than the estimated area at the end of 1936. While the actual increase in the acreage is not great there was a material improvement in the cultivations. Much of the unsuitable land planted during the early stages of the industry, amounting to approximately 168 acres, have been thrown out of cultivation as being uneconomic and land for the newer plantings totalling approximately 240 acres has been selected with a greater regard for the requirements of the banana plant. It is now generally recognised that exposure to wind is, apart from Panama disease, probably the most harmful factor in the cultivation of bananas in St. Vincent and this has resulted in a considerable reduction of interest in the crop in the Windward districts, with a consequent restriction of the new plantings to the sheltered Leeward valleys and to the more humid areas of the Carib Country.

Production. Weather conditions in 1937, however, were not favourable for banana cultivation and affected adversely both the development of the plants and the quantity and quality of the fruit. There was a considerable increase in the production of fruit and the total quantity of fruit sold to the Canadian Banana Company amounted to 75,434 stems valued at £6,366 as compared with 35,550 stems valued at £2,737. The percentage counts also showed some improvement and an average 67.38 as against 63.7 in 1936 but the figure is still too low despite the fact that during the year six hands were accepted on only three occasions. This consistent production of fruit with an average count bunch percentage less than seventy would definitely seem to indicate that much of the fruit is being produced under unsuitable conditions. It is anticipated, however, that with better lands coming into production, the grade will show some improvement in 1938. Table XII shows the details of fruit delivered to the Banana Association during the past three years from July 1935.

TABLE XII.

	1935.	1936.	1937.
9 Hands	1,285	6,192	14,773
8 ,,	1,648	10,180	24,197
7 ,,	2,438	16,138	35,148
6 ,,	399	3,040	1,316
Total Stems	5,770	35,550	75,434
Count bunches	3,840	22,661	50,834
Percentage counts	66.5	63.7	67.38
Value	£ 464	£ 2,737	£ 6,366
Rejects	360	2,985	——

The standard of cultivation has improved and where bananas show promise of being an economic crop considerable attention is being paid to cultural treatment. The objectionable practice of allowing suckers to grow in commercial fields for use as planting material has been generally discontinued and growers are

now pruning along the recommended lines. Manuring has received some attention but it is not generally recommended that this crop be manured as the margin of profit is not great enough to warrant the production of bananas on any but the most suitable land. Also manuring is further complicated by the fact that an increase in bunch weight need not necessarily be correlated with a higher grade.

Diseases. Panama disease is prevalent in the Windward district south of the Colonarie river and in the Marriaqua valley. North of the Colonarie river the incidence was not high and was low in the Leeward districts until recently. Certain Leeward areas which were quite free in 1936 are now infested and though in general the incidence is low it tends to be rather higher along the banks of streams and in low lying areas. As in 1936 diseased plants were destroyed with Panama Disease Killer oil supplied free of charge by the Agricultural Department.

Cercospora disease was first recorded in St. Vincent in September, 1937, when it was observed on an estate on the Leeward Coast. Since then it has also been found on another estate further north belonging to the same owner. The areas affected are not great and the damage done was slight. All diseased material is being destroyed by burning in an effort to prevent or retard the spread of the disease but it is feared that with the rather spasmodic type of growth characteristic of most areas in St. Vincent, conditions may be favourable for the spread of the disease. It is proposed to carry out spraying experiments in 1938 for the control of the disease along the lines recommended by Stahel in Surinam (Tropical Agriculture XIV, 12, pp. 257-264).

Pests. Towards the end of 1936 spotting of bananas from certain districts were resulting in a rather alarming percentage of rejects. The fingers, especially the outside surfaces were covered with a large number of small dark pits. Material was submitted to the Imperial College of Tropical Agriculture, and Dr. Wardlaw reported that the spotting arose as a result of punctures made by some insect followed later by the invasion of the wounds by weak fungal parasites. Investigations in the affected areas by Mr. A. K. Briant, then Agricultural Superintendent, showed that small raised spots were present on the fruit in the early stages and were probably caused by a species of thrips. Later, Mr. F. A. Squire, Entomologist, was able to show that the species of thrips concerned was the common West Indian flower thrips, **Frankliniella insularis,** and that the raised spots were due to the depositing of eggs by the thrips in the tissues of the young banana fruit. This represents a complete departure in the habits of the insect which normally lives on and oviposits in the petals of leguminous flowers as mentioned by Messrs. Squire and Briant (Tropical Agriculture XIV, 12. pp. 351-352). The destruction of all leguminous cover crops in the affected areas resulted in a very satisfactory reduction of the spotting and at present the condition has practically disappeared.

Minor Industries.

Cocoa. The production of cocoa in St. Vincent has steadily declined in recent years until now the industry occupies only a very minor position. Conditions in St. Vincent are not suitable

for the cultivation of this crop and with the disastrous decline in the price of this commodity the cultivation of the crop has become unprofitable. During 1937 exports totalled 50,156 lb. valued at £843 and were considerably greater than exports in 1936. This increase in exports was in part due to better yields in 1937, but was chiefly the result of the improved prices which for a period in 1937 reached new high levels and actually touched $16.00 per fanega in Trinidad.

Maize. The exports of maize in 1937 amounted to 65,194 lb. valued at £161 as compared with 5,368 lb. valued at £22 in 1936. General shortage of the South American and West Indian crops resulted in a better demand early in the year for the St. Vincent product which is now grown chiefly for local consumption. The majority of the corn shipped represented stocks held over from previous years.

Sweet Potatoes. Exports of sweet potatoes in 1937 amounted to 4,860 bags of 120 lb. valued at £1,458, a slight increase on the quantity exported in 1936 but still much below the quantity exported in 1935 and previously. This crop is also now grown principally for local consumption because of the decreased demand in Trinidad, the chief market for St. Vincent sweet potatoes. The greater part of the shipments occurred in the first quarter of the year after which exports markedly decreased. Early shipments consisted of potatoes grown between cotton but later conditions were too dry for planting and the available supplies decreased considerably.

Limes. The total acreage devoted to limes is not known with any accuracy but it is estimated that there are about 30 to 35 acres under this crop. There are no well established plantations and the crop is chiefly produced by more or less isolated trees in peasant gardens. During the period of activity of the Government Fruit and Vegetable Bureau some interest was shown in the crop, but since the closing of the Bureau in July 1935 little attention is devoted to this industry, although a limited quantity is still being exported to the Canadian market by the Government Cotton Ginnery.

The estimated production in 1937 was 1,000,000 limes of which 554,712 or approximately 50% valued at £148 were exported. More than half the total quantity, namely 292,880, were exported to Barbados by intercolonial "speculators" and "traffickers" and the remainder, 261,832, to Canada by the Government Cotton Ginnery.

The St. Vincent lime crop is relatively late and consequently it is not possible to obtain large shipments before June and by the time the limes arrive in Canada the market is usually flooded and is moreover very uncertain because of variable weather. Four shipments totalling 585 crates were made by the Ginnery in 1937, the first on June 9th and the last on July 21st. The average gross price per crate was $1.18 and the total expenses per crate amounted to $1.33 so that there was a loss per crate of $0.15 or a total loss of £20. 3. 4 on all the shipments. In view of the lateness of the St. Vincent crop and the uncertainty of the northern markets after the end of June the shipping of green limes to Canada will always be a risky and frequently unprofitable venture as far as St. Vincent is concerned.

SECTION II.

Botanic Gardens.

The ornamental shrubs planted in 1936 suffered from the severe dry weather and made little progress during the year. The large number of surface roots of the numerous large and old established trees also tended to interfere with the growth of the more recent plants and it was found necessary to remove all roots from the soil around the shrubs. Later in the year an attempt was made to relieve further the monotony of green of the Gardens by growing a large number of flowering annuals. Zinnias did very well and towards the end of the year phlox and petunias made a particularly good show, probably because of the relatively dry weather.

The budded citrus planted in the old cocoa field also made rather unsatisfactory growth during the year largely as a result of the drought. The plots were interplanted with cover crop— Canavalia sp. — and the citrus plants were frequently mulched with Gliricidia prunings, but in spite of this the plants suffered a good deal from the attacks of scales and had to be frequently sprayed.

The two species of Derris planted at the northern end of the cocoa piece also made very slow growth. Climatic conditions do not appear to be altogether satisfactory for this plant although St. Vincent soil would appear to be almost ideal for the development of a root crop.

Importations.

The following seeds and propagating material were imported during the year:—

(a) Through the Commissioner of Agriculture —

(1) onion seeds from Teneriffe
(2) Early Patna Cauliflower seed from India
(3) four sugar cane varieties B 3013, B 3125, B 3127, B 3234.

The following plant material imported by private individuals was examined under the provisions of the Plant Protection Ordinance, 1935:—

Vegetable and other seeds	..	46 parcels.
Ornamental and other plants	..	28 parcels.

Nurseries and Plant Distribution.

The plants and propagating material distributed by the Department during the last three years are given in Table XIII.

TABLE XIII.

	1935.	1936.	1937.
Plants.			
Tomato ..	12,500	—	—
Onion ..	400	—	—
Cabbage ..	1,450	—	—
Lime budded ..	6	13	—
Mango ..	107	528	43
Grapefruit budded	98	129	73
Orange „	104	126	198
Avocado pears ..	—	—	—
Coconut ..	21	41	11
Papaw ..	—	—	—
Pineapple ..	48	—	—
Decorative (Misc.)	478	93	497
Economic „	13	4	10
Cuttings.			
Sugar-cane ..	8,900	28,432	44,850
Sweet potato ..	—	218	—
Yam ..	—	459	503
Rhizomes.			
Arrowroot ..	9,867 lb.	2,000 lb.	3,650 lb.
Seeds.			
Groundnut ..	8 „	35 „	—
Cover Crops ..	20 „	1,351 „	340 „

Sugar-Cane. The distribution of the variety B 2935 was continued during the year. This variety did not in general appear to live up to its high reputation as a cane very suitable for drier areas but this appeared to be due in some measure at least to the poor start the plants received in most cases. Cuttings planted in November, 1936, were subject to the exceptionally dry season in 1937 before they were fully established and in consequence many actually failed completely. It has been stated by the British West Indies Central Sugar Cane Breeding Station that while this variety will tolerate dry conditions when fully established it requires very favourable conditions in the initial stages. In St. Vincent canes are planted in November and it very frequently happens that weather conditions may not be very favourable for quick establishment before the dry weather sets in.

The four varieties B 3013, B 3125, B 3234, B 3127, were received from the Central Sugar Cane Breeding Station through the Plant Quarantine Station in May and were propagated by the rapid method developed by the Barbados Department of Agriculture. The plants made very fair progress and it is hoped to have sufficient planting material to conduct at least two varietal trials in 1938-39.

Guatemala Grass. Cuttings of this grass were introduced from Dominica in April and a small area was planted at the Experiment Station. The plants grew extraordinarily well and give promise of being very successful under St. Vincent conditions. A fair number of cuttings were distributed during 1937 to both peasants and estates and reports received indicate that the plants are making good progress. Should the grass prove to be a successful ratooner under St. Vincent conditions it will be a very useful addition to our fodder grasses and because of its very rank growth it is likely to play an important part in the restoration of eroded lands.

Soya Beans. The soya beans introduced in 1936 proved very disappointing. The growth of the plants was poor and both the size and number of pods produced were small. The best varieties were selected and resown on the same land in the hope that by this procedure better plants would be obtained as a result of acclimatisation, but once again the growth and fruiting were poor. It is proposed to continue with the selections for another season and if no improvement is noted, the work will be discontinued.

Breadfruit. During 1937, 20 breadfruit plants grown at the nurseries in kerosene tins were transplanted to the Southern Grenadines at the commencement of the rainy season. Twelve of the plants were planted in the Government Reserve at Union Island, eight distributed to various responsible persons at Union, Mayreau and Canouan. During a visit paid to these islands early in 1938 the plants appeared to be doing reasonably well. The critical period, however, will be the dry season in 1938 when during the so-called "let-go" season stock are allowed to roam feeding on whatever is available because of the scarcity of fodder.

EXPERIMENTAL WORK.

COTTON.

A combined Variety and Manurial Trial. Since 1930 a single strain of Sea Island cotton, the superfine V 135, has been exclusively grown in St. Vincent. This strain, which produces the finest and longest commercial lint, usually commands a premium over other types of Sea Island cotton but this premium varies considerably from year to year and doubts have been frequently expressed as to whether in general the price difference has been great enough to compensate for the low yield of V 135. Many growers have felt that the Montserrat strain, with an average yield of 189 lb. of lint per acre in Montserrat as compared with 118 lb. per acre of V 135 in St. Vincent would perhaps be a more profitable crop. Also spinners have frequently stated that the demand for the superfine V 135 lint is extremely limited and the possibilities of increased production would appear to be greater in the case of the Montserrat strain. The prosperity of a very large section of the community, especially of the peasantry, depends to a great extent on the production and ready sale of a reasonably large crop, so that means whereby the return per acre may be increased are constantly under consideration and it is obvious that a change to the Montserrat variety would appear to be one such means provided that the arguments quoted above in its favour could be substantiated by actual facts.

The chief argument in favour of the Montserrat strain, namely, its greatly superior yield, rests on the assumption that this superiority would be maintained under St. Vincent conditions. On the evidence available, however, it is not possible to say to what extent this superiority would be reproduced in St. Vincent and consequently it was decided that as a preliminary to any serious consideration of a change, the comparison of the two types under similar conditions in St. Vincent for several seasons would be necessary.

With this object in view two trials were laid down during the 1936-37 season in which the strains were compared under rather widely different soil and climatic conditions. As the Department was also investigating the manurial response of V 135, it was convenient to include with the varietal trial a manurial experiment and two combined trials were laid down, one at Cane Garden and the other at Camden Park. At Cane Garden the site chosen was a moderate westerly slope at the top of a rather steep headland more or less exposed to wind; the soil was the usual "Yellow Earth" so typical of much of the cultivated land of the island. At Camden Park the experiment was laid down on slightly sloping low lying land in a coastal valley between two steep slopes, well protected from wind; the soil was a dark coloured fairly heavy valley alluvium with a number of large boulders scattered over the area.

The design adopted for the manurial comparisons was the factorial type in which nitrogen, phosphate and potash, respectively in the form of sulphate of ammonia (3 cwt. per acre), superphosphate (2 cwt. per acre) and sulphate of potash (1½ cwt. per acre), were applied at two levels in all combinations. Each of the eight manurial treatments was subdivided into two sub-plots one of V 135 and the other of Montserrat and the manurial treatments were replicated in four randomised blocks. The main plots were 1/40 ac. in size and the cotton was sown on banks four feet apart, the plants being eighteen inches apart.

With the exception of the manurial treatments, the plots were treated in all respects as under estate cultivation. The plots in both experiments were sown during the last week in August and, although germination was good, heavy supplying was necessary as a result of mole cricket activity, and the stands were somewhat patchy in spots. The fertilisers were applied when the plants were about five weeks old.

The yields per acre of total seed cotton, total lint and white lint for the two experiments are given in Tables XIV and XV.

TABLE XIV.

CANE GARDEN.

Treatment.	*Seed Cotton.*		*Total Lint.*		*White Lint.*	
	Monts.	*V135*	*Monts.*	*V135*	*Monts*	*V135.*
1. Control (no manure)	497	512	169	136	119	100
2. Sulphate of Ammonia (3 cwt. per acre)	696	504	232	127	157	91
3. Superphosphate (2 cwt. per acre)	738	581	246	146	182	114
4. Sulphate of potash (1½ cwt. per acre)	656	474	227	121	153	93
5. Sulphate of Ammonia + superphosphate	760	994	259	257	174	216
6. Sulphate of Ammonia + sulphate of potash	669	534	232	131	151	104
7. Superphosphate + sulphate of potash	572	654	192	169	128	135
8. Sulphate of Ammonia + superphosphate + sulphate of potash	756	1149	257	305	165	244
Varietal Average	668	675	226	174	153	137

TABLE XV.

CAMDEN PARK.

Treatment.	Seed Cotton. Monts.	Seed Cotton. V135	Total Lint. Monts.	Total Lint. V135	White Lint. Monts.	White Lint. V135.
1. Control (no manure)	470	676	150	157	134	135
2. Sulphate of Ammonia (3 cwt. per acre)	644	804	219	189	187	160
3. Superphosphate (2 cwt. per acre)	684	641	224	150	202	127
4. Sulphate of potash (1½ cwt. per acre)	631	671	200	154	174	129
5. Sulphate of Ammonia + superphosphate	440	667	141	157	120	127
6. Sulphate of Ammonia + sulphate of potash	770	977	252	234	210	194
7. Superphosphate + sulphate of potash	634	804	202	184	176	161
8. Sulphate of Ammonia + superphosphate + sulphate of potash	682	827	221	195	172	159
Varietal Average	619	758	201	178	172	149

Statistical analysis of the results showed that there were significant differences between the yields of the two varieties as well as between the manurial responses and also that the two varieties did not respond in the same manner to manuring.

The main points with respect to manurial treatments were as follows:—

1. Sulphate of ammonia produced significant average increases per acre of 175 lb., 49 lb., and 35 lb. of total seed cotton, total lint and white lint respectively at Cane Garden. Similar average increases of 64 lb., 23 lb., and 11 lb. were produced at Camden Park but here the increases were not statistically significant.

2. At Cane Garden superphosphate produced average significant increases of 204 lb., 55 lb., and 49 lb. per acre of total seed cotton, total lint and white lint respectively. The addition of superphosphate at Camden Park on the other hand resulted in well marked, though not significant, decreases in yield.

3. Sulphate of potash produced very small and not significant increases at Cane Garden but large and significant increases of 105 lb., 32 lb., and 23 lb. per acre of total seed cotton, total lint and white lint respectively at Camden Park.

4. There was a significant interaction between nitrogen and phosphate at both centres. At Cane Garden the effect was positive, that is the response from either sulphate of ammonia or superphosphate was greater in the presence of the other, but at Camden Park the effect was negative.

These results tend to support those obtained previously, namely that nitrogenous manuring is the only type of fertilising that may be expected to give consistently higher yields under St. Vincent conditions. The relatively smaller increases from

nitrogen at Camden Park were due in some measure to boll shedding and rotting during the very wet weather in January, the losses being much heavier at Camden Park than at Cane Garden. The chief effect of sulphate of ammonia seems to be the production of a large top crop so that the pickings from plants receiving this treatment continue for a much longer period. The effects of phosphate and potash though evidently important are less clear and in fact may even be contradictory as in the case of phosphate. It is hoped that with fuller information in respect of soil conditions it may be possible to explain these results but so far it is impossible to predict with any certainty the effect of either potash or phosphate.

The main points with regard to varietal behaviour were:—

1. The yields of seed cotton were practically identical at Cane Garden but there was a significant difference in favour of V 135 at Camden Park.

2. The Montserrat variety produced significantly greater yields of total lint at both centres.

3. The yield of white lint was greater in the case of Montserrat at both centres, but the differences were not significant.

4. The two varieties did not respond in the same manner to manuring at Cane Garden. The response of Montserrat was decidedly smaller to all manurial treatments.

The fact that Montserrat produced significantly greater yields of total lint at both centres although there was no difference in yield of seed cotton at Cane Garden and actually a difference in favour of V 135 at Camden Park clearly indicates that the superior yield of total lint was due to the higher ginning percentage of Montserrat. In point of fact the average ginning percentage of Montserrat was 33.8 whereas it was only 25.6 for V 135. It should be noted, however, that under the drier conditions at Cane Garden the relative performance of Montserrat improved and the yield of seed cotton did not differ from that of V 135 at this centre, so that there are indications that the superiority of Montserrat would tend to increase under drier conditions. As was stated above conditions at Cane Garden were more typical of average cultivated land, especially of peasant cultivated land in St. Vincent.

Under the conditions of the experiment the superiority of Montserrat was due only to its higher ginning percentage and, as ginning percentage is a genetic character capable of improvement, selection within V 135 for high ginning percentage while retaining all its present lint characteristics would be more desirable than a change in the variety grown. It would be unwise, however, to draw general conclusions from a single year's results, especially during a season when weather conditions were so exceptional, and the experiments are to be repeated for at least two years.

Pink Bollworm Investigations.

(Summary prepared by Mr. F. A. Squire).

Funds provided partly by the Colonial Development Fund and partly by the West Indian Sea Island Cotton Association made possible the appointment of an entomologist (Mr. F. A. Squire) to investigate the possibilities of control of the pink bollworm in the Windward and Leeward Islands.

Mr. Squire assumed his duties in September 1936, and at first confined his efforts to defining the sources of reinfestation. It was soon found that infestation was due to a number of contributory factors rather than to any one cause. Among these inter-island traffic, failure to uproot all cotton plants and an inadequate close season are the most important, while in a few instances peasants were found keeping badly infested seed cotton in their homes during the close season.

The resting stage or diapause was closely studied in the different islands and it has been concluded that it is not due to prevailing temperature or humidity as has been suggested by workers elsewhere, but that it begins towards the end of the crop and is induced by the gradual change in quality of the food as the ripe boll stage supervenes. Laboratory experiments have shown that the diapause is terminated by the addition of moisture to the tissues.

The practical importance of the above phenomenon is well illustrated by the following. Resting larvae were found in residual cotton seed in the field in Barbados three months after the crop was uprooted at the beginning of March. In St. Vincent certain fields were so badly infested towards the end of the season in April, that it was practically impossible to find a single uninfested boll, yet only three weeks after the uprooting of the crop not a single pink boll worm could be found in the residual material. This striking difference may be attributed to rainfall.

The Cotton districts of Barbados are dry and the dry season may extend well into June, whereas in St. Vincent, though the drought may be exaggerated by the porosity of the soil, the actual precipitation is quite considerable even at the beginning of the close season.

	St. Vincent Botanic Gardens Average rainfall 42 years.	*Barbados. Average for 6 yrs. in the cotton districts of Christ Church, St. Phillip and St. Lucy.*
Feb.	4.20	1.8
Mar.	4.02	1.6
April	4.00	1.8
May	6.71	1.5
June	10.88	4.6
July	11.76	4.6

Experiments in St. Vincent showed that bolls whether buried or exposed completely disappear during the close season and that resting larvae in seed buried at a depth of 6—9 inches do not survive.

Arrowroot.

Manurial Experiments. 1. **Pen-manure versus sulphate of ammonia.** In previous experiments, recorded in the Annual Reports for 1934 and 1935, it was not possible to estimate the residual effects of single dressings of pen-manure and sulphate of ammonia nor was it possible to compare directly the effects of pen-manure and sulphate of ammonia on yield. A trial was therefore laid down in 1936 in the form of a 6x6 Latin square

with plots 1/50 acre in size to enable these comparisons to be made.

The site was a fairly steep hillside at Union Estate with the land falling away very sharply below the experimental area. The soil was a low level yellow earth which had suffered from washing. This appeared to be the type of land likely to benefit most from applications of pen-manure.

The pen-manure was applied when the previous crop was being dug on 2. 6. 36, the manure being worked into the soil and the sulphate of ammonia when the plants were slightly less than three months old.

The treatments and yields in lb. of rhizomes per acre are given in Table XVI.

TABLE XVI.

Sulphate of Ammonia	*Pen-manure per acre.* Nil	10 *tons*	20 *tons*	*Average. lb. per acre.*
Nil	12,720	16,568	18,717	16,021
300 lb. per acre.	18,001	21,158	24,265	21,167
Average lb. per acre	15,379	18,886	21,517	

The statistical analysis of the results showed that treatment had a highly significant effect on yield and that the two manures acted quite independently when added to the same plots.

The average increase in yeild due to 300 lb. of sulphate of ammonia was 5,146 lb. of rhizomes per acre or 32%. Pen-manure applied at the rate of 10 tons per acre produced an increase in yield of 3,505 lb. per acre or 23% while when applied at the rate of 20 tons per acre the increase was 6,138 lb. per acre or nearly 40%. It is to be noted that the increase in yield from 20 tons of pen-manure was very nearly double that from 10 tons and in fact statistical analysis indicates that there was no significant difference between the effects of the first 10 tons and the second 10 tons so that it may be taken for practical purposes that even 20 tons of pen-manure per acre did not nearly satisfy the requirements of the soil and that a considerably larger dressing might have been beneficial. Admittedly, the pen-manure used in this experiment was of poor quality as indicated by the analytical report furnished by Prof. F. Hardy of the Imperial College of Tropical Agriculture, but even so the results tend to indicate the great deficiency of nitrogen in certain St. Vincent soils for it is obvious that the effect of pen-manure was chiefly due to its nitrogen content as shown by the large increase in yield from sulphate of ammonia.

Analytical Report.

		Partly dried material as received. (per cent.)	Oven-dried material. (per cent.)
Moisture	...	45.73	—
Ash	...	42.25	77.84
Total organic matter	...	12.02	22.16
Nitrogen	...	0.54	1.00
Phosphate(P_2O_5)	...	0.32	0.59
Potash (K_2O)	...	0.22	0.41

The manure contained excessive amounts of "ash" substances, possibly soil or other earthy contamination. The nitrogen content and the potash content are rather low, but the phosphate content is medium in amount. Good English "Standard" farmyard manure (oven-dried) contains 67 per cent. of organic matter, 11 per cent. of ash and 2.4 per cent. of nitrogen. Good Trinidad pen-manure (oven-dried) contains 32 per cent. of ash, 1.8 per cent. of nitrogen, 0.80 per cent. phosphate, and 1.84 per cent. potash.

From a consideration of the relative increases from pen-manure and sulphate of ammonia, it may be seen that the increases from 300 lb. of sulphate of ammonia would correspond to the increase from a dressing of about 15 tons of pen-manure per acre.

The 23% average increase in yield from 10 tons of pen-manure per acre corresponds very closely to results previously obtained in 1934-35 when the average increase from this dressing was 25% and also with the results obtained by Mr. Jackson in 1932 who found that an increase of 23% was produced by 10 tons per acre and 48% increase by 20 tons per acre.

It was shown in the 1934 Report that the profits from an application of 10 tons of pen-manure per acre compared unfavourably with the estimated profits from an application of 300 lb. of sulphate of ammonia per acre. It was then assumed that this latter dressing produced the same increase in yield as 10 tons of pen-manure but the results quoted above indicate that the increase from the sulphate of ammonia may be much greater so that the comparison becomes even more unfavourable. As it is possible, however, that the pen-manure may have a considerable residual effect, it would be unwise to draw too hasty a conclusion and a final comparison will not be justified until the full effect of the pen-manure is known.

II. **Time of Application of Sulphate of Ammonia.** The results of previous experiments published in the Annual Reports for 1934 and 1935, showed that the optimum time of application of sulphate of ammonia was about three months after planting or digging and also that no advantage was derived from splitting the application into two or more doses. As the correct time of application is a matter of considerable practical importance it was decided to confirm these results by a similar experiment in 1936-37.

The experiment was laid out in a third "ratoon" field in the form of a 6x6 Latin Square, with rectangular plots 1/40 acre in size having a three foot discard between plots, on a moderately sloping hillside at Union Estate. The experimental area which had been dug rather late in 1936, suffered somewhat from washing in the subsequent rains especially in one corner where the land fell away steeply and the stand tended to be somewhat patchy.

The treatments and yields in lb. of rhizome per acre are given in Table XVII. The sulphate of ammonia was as usual broadcast by hand over the plots.

TABLE XVII.

Treatment. (*lb. Sulphate of ammonia per acre.*)	*Yield* (*lb. per acre*).
1. Control (No. manure)	10,625
2. 300 lb. at 6 weeks (18. 6. 36)	16,188
3. 300 lb. at 3 months (1. 8. 36)	17,302
4. 300 lb. at 4½ months (18. 9. 36)	15,441
5. 100 lb. at 18. 6. 36 + 200 lb. at 1. 8. 36	15,168
6. 50 lb. at 18. 6. 36 + 100 lb. at 1. 8. 36 + 150 lb. at 18. 9. 36	15,334

Statistical analysis showed that all treatments produced significantly higher yields than control. Also while there was no significant difference between treatments 2, 3, and 4, treatment 3, an application of 300 lb. of sulphate of ammonia when the plants were three months old produced the highest yield and was significantly greater than yields from treatments 5 and 6.

The results therefore, strongly support those previously obtained, namely that sulphate of ammonia produces its maximum effect if applied when the plants are about three months old and that no advantage is to be gained by applying the manure in two or more doses—in fact there may be a slight loss by so doing.

The remarkably large increases in yield from the sulphate of ammonia treatments are worthy of note. The average increase in yield from all plots receiving sulphate of ammonia over the no manure plots was 49%. It must be pointed out, however, that the no manure plots suffered more from erosion than the plots receiving sulphate of ammonia because of the smaller vegetable development of the plants and consequently the poorer cover afforded to the soil on these plots. One of the results from the application of the fertiliser was therefore in some measure a soil conserving effect.

III. **Factorial Experiments.** It was pointed out in the Annual Report for 1935 that the manurial trials previously conducted, while providing very valuable results, were not designed to yield information on the response to the simple nutrients nitrogen, phosphate and potash, nor could their interactions be determined. In consequence a new series of experiments was begun in which the factorial design was adopted. This design makes possible the study of the direct effects of the fertilisers as well as their interactions on each other within one experiment and provides a valuable method of studying the manurial response of a crop on various soil types as a preliminary to more detailed work.

The first two of this series were described in the Annual Report for 1935 and four more were laid down in the 1936-37 season. In these latter trials nitrogen, phosphate and potash were applied as sulphate of ammonia, superphosphate and sulphate of potash respectively at three different levels. The three dressings of the three manures were:—

1. Sulphate of ammonia—
   no application (n_0)
   single ,, (n_1) = 300 lb. per acre.
   double ,, (n_2) = 600 ,, ,, ,,

2. Superphosphate—
   no application (p_0)
   single ,, (p_1) = 84 lb. per acre.
   double ,, (p_2) = 168 ,, ,, ,,

3. Sulphate of potash—
   no application (k_0)
   single ,, (k_1) = 45 lb. per acre.
   double ,, (k_2) = 90 ,, ,, ,,

The three levels of the three manures were combined together in all possible ways producing twenty-seven different manurial treatments which were subdivided into three blocks of nine treatments each. In this way one-third of the plots received no sulphate of ammonia, one-third received the single application and the remaining third received the double application of this manure and similarly for phosphate and potash.

The plots were each 20 feet by 60 feet with a three foot discard between adjacent plots so that the actual area of a plot was 1/43 acre and the three blocks were placed together in a compact rectangle. The fields chosen were all "ratoon" arrowroot and the manures were applied when the plants were two to three months old, after supplying. The experimental areas were treated in all respects with the exception of the manuring, as in ordinary estate cultivation. The four experimental sites were as follows:—

(a) **Grand Sable.** A flat slightly sloping field with a reputation for good yields. The soil is a "recent volcanic ash" and is extremely open and porous; very coarsely sandy.

(b) **Union.** A moderate slope on a somewhat eroded hillside. This field which had been under groundnuts previously is rather worn out and the rhizomes contained a fair proportion of "cigars." The soil is a "Low Level Yellow Earth" somewhat coarsely sandy and open at the surface but more compacted below.

(c) **Argyle.** A fairly steep and rather badly washed hillslope. The soil is a "Low Level Yellow Earth" and the "terras" subsoil has been exposed in parts by erosion. In general the depth is not great and the soil tended to be somewhat compacted.

(d) **Reversion.** A moderate slope at the base of a steep hill. The soil is a "Low Level Yellow Earth" which has suffered from erosion and is very porous, open and coarsely sandy, with a few large boulders scattered here and there. This field had been badly attacked by the arrowroot leaf roller in the previous year and the stand was consequently "thin." The fertility of this field was low as indicated by poor yields.

The average increases due to the various manurial treatments, expressed in lb. per acre and as percentage increases are given in Table XVIII.

TABLE XVIII.

Treatment	*(lb. per ac).*	*Grand Sable*	*Union*	*Argyle*	*Reversion*	*Average Increase.*
Sulphate of Ammonia	300 lb.	5,913 lb = 32%	7,303 lb=58%	5,627 lb=48%	3,512 lb = 69%	47%
	600 lb.	7,633 lb = 42%	8,780 lb=70%	6,024 lb=51%	4,577 lb = 90%	57%
Super-phosphate	84 lb.	—2,326 lb = —10%	817 lb= 5%	82 lb=0.5%	1,122 lb = 16%	—0.4%
	168 lb.	— 607 lb = — 3%	750 lb= 4%	277 lb= 2%	1,132 lb = 16%	2%
Sulphate of potash	54 lb.	425 lb = 2%	970 lb= 6%	1,467 lb=10%	1,496 lb = 23%	7%
	90 lb.	554 lb = 6%	1,085 lb= 7%	1,323 lb= 9%	2,656 lb = 41%	9%
Average yield (lb. per acre)		22,695 lb.	17,852 lb.	15,682 lb.	7,792 lb.	

At Reversion the experimental plots were completely defoliated by the arrowroot leaf roller and at the other centres the various plots were more or less defoliated, the nitrogen plots suffering the greatest damage.

Statistical analysis showed that manurial treatment had a highly significant effect on yield at all centres but that this was chiefly due to the remarkable results obtained from the applications of sulphate of ammonia. The chief results are as follows:—

1. **Sulphate of ammonia.**—This fertiliser, applied at the rate of 300 lb. per acre produced increases in yield varying from 32% to 69% with an average of 47%. Applications of 600 lb. per acre produced further increases but these increases were not proportional to the additional quantity of the fertiliser—the average increase being only 57% or just 10% greater than that due to the 300 lb. application.

2. **Superphosphate.**—The results from the application of this fertiliser were much less spectacular and in fact only at Grand Sable and Reversion were the effects statistically significant. At Argyle and Union the increases were very small. At Reversion a well marked average increase of 16% resulted from both the single and the double application tending to indicate that no further benefit is to be derived from applications greater than 84 lb. of superphosphate per acre. At Grand Sable on the other hand the fertiliser exerted a depressing effect on yield, the reduction being significantly greater in the case of the smaller application.
3. **Sulphate of Potash.**—At two centres, Reversion and Argyle, potash produced statistically significant increases in yield. At Reversion the increase from the double was almost twice that from the single application. At Argyle increases were much smaller and the double dressing gave practically the same results as the single, the average increase from which was 10%. At both Grand Sable and Union the increases were small and not significant.

Discussion. The very large increases in yield from the applications of sulphate of ammonia in spite of the much greater damage by the leaf roller to plots receiving this fertiliser once more confirm the evidence previously obtained of the great deficiency of nitrogen in St. Vincent soils. It is obvious that such a deficiency may be rectified by the addition of any nitrogenous manure, either artificial or organic, including sulphate of ammonia, nitrate of soda, cyanamide, farm-yard manure, fish manure, cotton seed meal, etc. The questions of the cost and availability of the manure are important, however, and from these points of view, sulphate of ammonia compares very favourably with the other manures, especially with the organics. It must be pointed out, however, that the effect of continued applications of manure in the form of artificial fertilisers on the fertility of the soil is not known and it is possible that periodic applications of bulky organic manures may be essential. With a crop like arrowroot, however, in the cultivation of which a very fair amount of organic matter is incorporated in the soil annually, when the rhizomes are being dug, the further addition of organic matter is not likely to be so important and consequently the application of nitrogen as sulphate of ammonia would appear to be reasonably safe as well as being immediately most profitable. The results presented above provide valuable indications of the optimum dressing of sulphate of ammonia—as was noted 600 lb. only produced a 10% increase on the yield from 300 lb. and such a rapid falling off in the yield curve seems to indicate that, on the average 300 lb. per acre may be expected to produce maximum profit. Contrary to popular belief the excessive application of this nitrogenous manure did not have a harmful effect on yield though it did reduce very materially the profit from the manuring.

Superphosphate. In general, superphosphate when applied by itself tended to depress the yield and it is not recommended that this fertiliser be applied except at Reversion where the application should not exceed 84 lb. per acre. At both Argyle and Union the depressing effect of phosphate was counteracted by a positive interaction with nitrogen so that the average effect of

the fertiliser was insignificant, but at Grand Sable the depressing action showed up in the average results in spite of this nitrogen and the results were exactly parallel to those obtained in 1935-36 at this centre.

Potash. In view of its well known action on root crops elsewhere, it was confidently expected that potash would have a very marked effect on the yield of arrowroot but these expectations have not been supported by the results obtained in practically all the recent manurial trials. With the exception of the increases obtained at Reversion the results from sulphate of potash have been mostly insignificant and although the yield curves do show a rising tendency the indications are that the increases to be expected would be small. At Reversion where the soil was undoubtedly very poor, the yield curve was practically a straight line showing that perhaps a larger application might have been beneficial, whereas, at Argyle it would appear that 45 lb. of sulphate of potash per acre was adequate.

Spraying Trials with Colloidal Lead Arsenate. The only serious pest of arrowroot in St. Vincent is the leaf roller, **Calpodes ethlius.** The pest is known to be attacked by a number of parasites which in general exercise fairly good control but under certain conditions the pest population may increase enormously and periodically large areas of arrowroot are completely defoliated resulting in heavy losses. It was shown that a single artificial defoliation may cause a reduction in the yield of rhizome from 18% to 38% depending on the age at which the plants were defoliated and, even after due allowance is made for the fact that the shock to the plants may possibly have been greater than under "natural conditions," the loss is serious. In addition to the decrease in yield of rhizomes there is also a reduction in the average starch content due to "springing" of the older rhizomes and to the large proportion of immature rhizomes obtained from damaged fields.

In the past dusting with Paris Green has been suggested as a control measure but it has not been generally adopted because in practice it has been found to be uneconomic. The attacks usually occur during the rainy season and apart from its relatively high cost the dust may be washed off the leaves soon after application. To be successful, therefore, it is essential that the poison adheres to the leaves even under conditions of heavy rainfall. A suitable insecticide appeared to be a preparation of colloidal lead arsenate produced by Lunevale Products Ltd., England, and towards the end of 1936 a small quantity of the material was obtained for trial spraying.

The lead arsenate is put up in 1 cwt. drums, which are very convenient for handling, and is in the form of a thick fluid. Following the directions of the makers a spraying suspension was first made up by the addition of 2 lb. of the lead arsenate to 100 gallons of water but experience showed that the quantity could be increased with advantage to about 3 lb. per 100 gallons. The lead arsenate remains in suspension for a considerable time and requires no agitation—this is a great advantage and makes possible a very uniform application of the insecticide to the leaves.

In the early trials a 3¼ gallon knapsack sprayer of the diaphragm pump type (Vermorel "Eclair" No. 1) was used and it was found that an untrained labourer could spray about one acre per day and after a little practice about 1½ acres.

A single application was very effective and though it cannot be claimed that 100% mortality was effected, the pest population could be so reduced that further damage was negligible. As a result of a number of trials carried out with the kind co-operation of Mr. Digby Hadley of Spring Estate average cost of spraying was found to be as follows:—

Trial No.	*Area in Acres.*	*Weight in oz. of lead arsenate.*	*Cost per day of labourer.*
1	4¼	183	$ 4.19
2	2½	96	2.45
3	3	125	2.94
4	3	127	2.94
5	1¾	68	1.73
Total	14½	599	$14.35
Average per acre		2½ lb.	0.99

The cost of the colloidal lead arsenate landed in St. Vincent was approximately 9c. per lb. so that the total cost of spraying per acre was 0.99c. + 0.23 = $1.22. Assuming that under average estate conditions the cost of labour is $1.20 per acre and that 3 lb. of lead arsenate are used then the total cost of spraying may be estimated at $1.50 per acre. Later in the year the lead arsenate spray was used with great success against the cotton worm, **Alabama argillaceae,** and the cost per acre was approximately the same as in the arrowroot trials.

Arrangements have been made for the Arrowroot Association to purchase lead arsenate in bulk for distribution to growers and all large growers are being advised to obtain spraying equipment. The Department of Agriculture has a number of sprayers which will be used for spraying peasant arrowroot should the necessity arise.

Syrup Industry.

A summary prepared by Mr. C. C. Seale, Crop Specialist, (Sugar), of work performed during 1937 in connection with the Syrup Industry.

A. FACTORY OPERATIONS.

General. During the 1937 crop syrup was manufactured at nine estate factories and also at a few peasant owned mills. Three estate factories did not operate this year owing to the large reduction in acreage under sugar-cane for syrup production. The majority of factories commenced operating in March but one started early in January and another in July. Late or early starting is inadvisable and should be avoided whenever it is possible.

The importance of carefully controlling the various processes in the manufacture of syrup is gradually being realised by factory owners. During 1937 three large producers followed the methods recommended while three others carried out instructions to a lesser extent. Instructions were also given to certain peasant producers who indicated their willingness to co-operate. This year only two factories could be induced to undertake the recording of milling, clarification and boiling data although the value of such records in providing a check on the working of the factory has been constantly emphasized.

During the crop visits were paid as frequently as possible to the different factories and tests were made to determine whether optimum results were being obtained. Also during these visits producers were instructed in the scientific principles of syrup production, the use of a suitable inverting agent, pH comparators and thermometers.

This year particular attention was paid to controlling:—

(1) Clarification
(2) Inversion
(3) Striking.

Milling. The mills in the majority of factories in St. Vincent are of a rather obsolete and inefficient type and generally consist of one unit of three rollers. Only two factories possess modern equipment but these are small and are not in very good condition. This year a test run on one of the three roller mills showed that only 96 Imperial gallons of juice were being obtained per ton of cane. This indicates poor milling conditions but it is believed that slightly better results are being obtained by other mills of a similar size. None of the three roller mills is provided with pressure regulators and the settings must necessarily be rather wide to avoid chokes and breakages. By suitable alterations it should be possible to obtain better extraction.

Clarification. The main object of clarification is the removal of colloidal and other impurities of the juice. If adequate clarification is not obtained at an early stage it becomes increasingly difficult to remove these impurities during the concentration of the juice, owing to the increasing density.

This year factory owners were advised to pay particular attention to the following points in order to obtain good clarification:—

(1) The maintenance of the clarified juice at a pH value of approximately 5.6 — 5.8 by a controlled system of liming.
(2) The intimate mixture of the milk of lime with the juice by means of a regulating device controlling the flow.
(3) The adequate heating of the juice to cause precipitation of the colloidal components; boiling, however, being avoided.
(4) The settling of the juice for a sufficiently long period to ensure subsidence of the impurities.

Inversion. In the manufacture of syrup the degree of inversion must be carefully controlled in order to obtain a finished product possessing the required polarisation and purity. If too little inversion has taken place crystallisation may occur and the Canadian Customs regulations stipulate that the polarisation of a syrup must not exceed 56° in order to enter Canada free of duty. On the other hand too great a degree of inversion may effect the flavour adversely.

The relationship between the pH value of the clarified juice after the addition of the inverting agent and the purity of the manufactured syrup was investigated at various factories. Results obtained showed that for open tayche factories a pH value

of approximately 4.5–4.6 of the clarified juice after the addition of the inverting agent would produce a syrup of satisfactory purity. In the case of Aspinal factories a pH value of 4.3–4.4 was required.

During the 1937 crop pH comparators were used regularly at three factories for determining pH values while at two others they were only used occasionally for this purpose. Routine purity determinations were not made at the various factories this year because none possessed polariscopes. These, however, were carried out during visits to the factories and also at the laboratory in Kingstown at various stages in the manufacturing process.

Striking. This year producers were advised to determine the striking point by means of thermometers, manufactured by Pastorelli and Rapkin with a range from 200° to 240° F. It has been found that a striking point of 224°F produces a syrup with a density of approximately 41° Beaume when cold. These thermometers were used regularly by the majority of factories for the purpose.

B. MANURIAL EXPERIMENTS.

(1) **Manurial Experiment at "Peters Hope."** This experiment was laid down on BH 10/12 plant canes and was designed to test the effect of fertilising the crop with dressings of nitrogen, phosphate and potash in various combinations.

Site and Planting Date. The experimental site was planted on November 1935 prior to its lay-out in July 1936 and was situated on moderately sloping hillside land on which cotton had previously been grown.

Lay-out. The lay-out consisted of four randomised blocks of eight plots each comprising a total area of 1.792 acres. The plot size including guard rows was 35 feet by 70 feet or 0.056 acres and excluding guard rows was 25 feet by 60 feet or 0.034 acres. The spacing of the individual stools was 5 feet by 5 feet.

Manuring. Manures were applied on 28th and 29th July 1936 and the plots receiving sulphate of ammonia could be distinguished 4 to 6 weeks later by their darker leaf colour and more vigorous tillering. The optimum time of application of manures is generally earlier in the growth period but in this particular case the experiment was laid down late in the season.

Sulphate of ammonia, superphosphate, and sulphate of potash were applied at the rate of 3 cwt., 2 cwt. and 1½ cwt. per acre respectively, singly and in various combinations.

Yields. The experiment was reaped on 19th, 20th and 21st April 1937 and the treatment yields in tons per acre are shown in Table XIX and the average increases in yield from the various treatments in Table XX.

TABLE XIX.

Treatment Yields in Tons per acre.

Control	N	P	K	NP	NK	PK	NPK	Standard Error.
20.09	25.12	20.78	20.92	24.88	24.48	22.41	25.96	± 1.009

TABLE XX.

Average increases in tons per acre for the various treatments.

Treatment.	*Average Increase tons per acre.*	*Standard error.*
3 cwt. sulphate of ammonia	4.06	± .504
2 cwt. superphosphate	0.86	,,
1½ cwt. sulphate of potash	0.72	,,

Statistical analysis of the results indicated:—

(1) All treatment yields in which nitrogen was included were significantly higher than those not receiving this fertiliser.

(2) There was no significant response to phosphate or potash either alone or in combination.

(3) There was no statistically significant interaction between nitrogen, phosphate and potash.

Discussion and Recommendations. The results of this experiment agree with the results of experiments previously carried out on arrowroot and cotton and indicate that there is a definite deficiency in the available supply of nitrogen in certain soils in St. Vincent. Under the conditions of this experiment phosphate and potash did not produce any significant increase in yield. Therefore, when these conditions prevail an application of sulphate of ammonia at the rate of 3 cwt. per acre is recommended, whereas it would appear to be uneconomic to apply phosphate and potash.

(2) **Manurial Experiment at "Argyle".** This experiment was laid down on B 2935 plant canes at "Argyle" estate and was designed to test the response of this variety to varying applications of nitrogen applied as sulphate of ammonia under dry conditions.

(3) **Manurial Experiment at "Pembroke."** This experiment was laid down on BH 10/12 plant canes at "Pembroke" estate and was designed to test the response of this variety to varying applications of nitrogen supplied as sulphate of ammonia under wet conditions.

C. Pests and Diseases. During the 1937 crop the amount of damage caused by the two species of small moth borer (**Diatraea saccharalis** and **D. canella**) was estimated by selecting canes at random in the factory yards and counting the number of joints which had been bored. The percentage of joint infestation was determined from counts made on 5,300 canes or 75,477 joints. The average joint infestation for eight estates was 19.4%. The Windward side of the island with a joint infestation of 14.81% was less heavily infested than the Leeward side with 25.73%.

The counts made on the individual estates are given below in Table XXI.

TABLE XXI.

Moth Borer Counts 1937.

Estate	*Joints*	*Bored*	*% Joint Infestation*	*Average % of Joint Infestation.*
"Peters Hope"	13,851	5,393	38.94	
"Rutland Vale"	6,366	752	11.81	
"Cane Grove" and "Penniston"	5,412	878	16.22	Leeward
"Pembroke" and "Camden Park"	6,054	1,130	18.67	25.73
"Fair Hall"	9,196	1,287	14.00	Windward
"Argyle"	6,962	1,687	24.23	
"Spring"	9,485	2,215	23.35	14.81
"Mt. Bentinck"	18,151	1,297	7.15	
Totals	75,477	14,639	19.40	

The moth borer incidence in 1937 was considerably higher than during the previous four years and although in certain districts this might have been caused by inadequate field sanitation, it would appear advisable that their biological control by the introduction of suitable parasites be considered.

In order to reduce the damage caused by these pests planters have been advised to:—

(1) soak all cuttings in milk of lime before planting;
(2) cut the canes as low as possible when reaping;
(3) pay particular attention to field sanitation;
(4) avoid leaving stand-over canes in the field, which might be a source of infestation to other areas.

Agricultural Education.

During the past few years the Field Assistant has devoted much of his time to visiting peasants and advising them in agricultural matters and in addition other officers have also assisted in this work from time to time, more particularly in connection with special problems. It was evident, however, that satisfactory progress in the agricultural education of peasants could only be made by the provision of an adequate staff for the purpose. In his review of the Report for 1936, the Commissioner of Agriculture drew attention to the need for the extension of the activities of the Department in this direction and this view was strongly supported by the Administration with the result that proposals were drawn up for the appointment of Agricultural Instructors in 1938, whose chief duties would consist of educational work among the peasantry.

The Acting Agricultural Superintendent examined Pupil Teachers in Agriculture and Botany in September. The standard of the answers generally was not high and indicated that whereas the candidates could reproduce what they had read with a fair degree of accuracy, their powers of observation were with few exceptions, poorly developed and their practical knowledge almost negligible. Thirty-eight candidates submitted papers in Agriculture and four in Botany; of these twenty and one respectively failed to attain the pass standard.

Official Visitors.

The following gentlemen visited the Agricultural Department during the year:—

Mr. G. A. Jones, Commissioner of Agriculture, to discuss and advise on general agricultural matters from 13. 3. 37 to 23. 3. 37.

Mr. C. T. Watts, Imperial College of Tropical Agriculture, on a visit of inspection, Government Cotton Ginnery, from 3. 2. 37 to 9. 2. 37.

Mr. H. Macluskie, Agricultural Superintendent, British Guiana, to study Peasant Land Settlements prior to taking up his new appointment in Sierra Leone.

Mr. J. G. Davies, Sugar Technologist, Imperial College of Tropical Agriculture, to report on the syrup investigations.

Other visitors included Sir Geoffrey Evans, Principal, Imperial College of Tropical Agriculture, Mr. R. W. R. Miller, Director of Science and Agriculture, Barbados, Mr. H. B. Pidduck, Agricultural Assistant, Dominica, Mr. C. C. Skeete, Assistant Commissioner of Agriculture, Dr. C. W. Wardlaw and Mr. O. J. Voelcker, of the Imperial College of Tropical Agriculture, and Dr. M. Nierenstein, University of Bristol.

Change of Staff.

Mr. A. K. Briant, Superintendent of Agriculture was offered and accepted an appointment in Zanzibar while on leave in England at the end of the year. Mr. Briant's loss will be greatly felt both by his colleagues in the Agricultural Department and by the planting community generally.

During the period of Mr. Briant's leave, the duties of Agricultural Superintendent were performed by Mr. C. K. Robinson, Agricultural Assistant.

SECTION III.

Financial Statement

The sum of £3,135 was voted for the maintenance of the Agricultural Department during the year, whereas the amount voted for 1936 was £3,009. The former figure does not include the sum of £451 voted from the Colonial Development Fund for Syrup Investigations.

The actual expenditure for the year was as follows:—

	£	s.	d.
Salary, travelling allowance, Agricultural Superintendent ..	600	13	9
Salary, travelling and house allowance, Agricultural Assistant ..	268	9	10
Salaries and travelling allowances, Instructor and Field Assistants for the Banana Industry	315	0	0
Travelling allowance, Cotton Research Officer, salaries Laboratory and Clerical Assistants to Cotton Research Officer ..	118	9	6
Carried forward	1,302	13	1

	£	s.	d.
Brought forward ..	1,302	13	1
Salaries, Foreman, Botanic and Experiment Stations, Field Assistant, Clerical Assistant, Cadets, and travelling allowances of Field Assistant and Cadets, and special travelling expenses ..	368	3	0
Upkeep, Botanic, Experiment and Cotton Stations, Government House Grounds, (Labour, manures, insecticides, tools, seeds, &c.) ..	672	8	5
Special Cotton Investigations ..	79	4	6
Destruction of Food Plants of the Cotton Stainer and diseased Banana plants ..	26	12	8
Contribution to various Scientific Institutions ..	423	16	8
From Colonial Development Fund —			
Salary, travelling and house allowance Crop Specialist (Sugar) ..	365	1	10
Miscellaneous expenditure for Syrup Investigations ..	64	10	7
Total	£3,302	10	9

The receipts for the sale of plants and produce at the Experiment and Botanic Stations amounted to £60. 8. 9.

SECTION IV.

Summary of Agricultural Legislation 1937.

Ordinances.

No. 8 of 1937	To amend the St. Vincent Co-operative Arrowroot Association Loan Ordinance, 1931.
No. 17 of 1937 and No. 18 of 1937	To amend the Land and House Tax Ordinance, Cap. 194.
No. 27 of 1937	To amend the Labour (Minimum wage) Ordinance, 1934. To provide for the appointment of a Labour Commissioner and a definition of the conditions of employment of persons incapable of earning the minimum wage.
No. 28 of 1937	Sugar Control Ordinance—to regulate the manufacture of sugar in the Colony, the disposal of such sugar, the allocation to local manufacturers of quotas for exportation and for sale for local consumption and for other purposes connected therewith.

Orders in Council.

8th January.	Under the Labour (Minimum Wage) Ordinance, 1934. Fixing minimum rates of wages for agricultural labourers.

Orders in Council.

16th January.	Under the Agricultural Credit Societies Ordinance, 1934. Appointing Treasury Bailiff for recovery of loans from members of the Redemption and Troumaca Agricultural Societies.
16th April.	Under the Cotton Protection Ordinance, Cap. 37. Declaring Close Season for St. Vincent and Grenadines.
27th April.	Under the Unrefined Sugar (Local Consumption) Ordinance, 1935. Fixing wholesale and retail prices of locally manufactured unrefined sugar.
30th April.	
2nd June.	Under the Cotton Protection Ordinance, Cap. 37. Appointing Inspectors.
20th October	Under the Plant Protection Ordinance, 1935. Prohibiting the transfer or conveyance of Seed Cotton from the St. Vincent Grenadines except under certain conditions.
20th December.	Under the Labour (Minimum Wage) Ordinance, 1934. Replacing Order in Council of 8th January, 1937.

Proclamations.

15th June.	Under the Plant Protection Ordinance, 1935. Prohibiting the importation of malvaceous plant material from certain countries.
15th December.	Under the Plant Protection Ordinance, 1935. Permitting the importation of raw coffee from British Guiana under certain conditions.

APPENDIX I.

Meteorological Observations.

The rainfall recorded at various centres in St. Vincent during the year 1937 and the average rainfall recorded at the Botanic Gardens for the last 44 years are given in Table XXII.

TABLE XXII.

Stations.	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June.*	*July.*	*Aug.*	*Sept.*	*Oct.*	*Novem.*	*Dec.*	*Total*
Chateaubelair ..	9.44	1.83	1.95	1.78	.77	11.80	7.75	11.63	9.46	8.63	7.99	5.99	79.02
Botanic Gardens ..	16.58	2.49	1.68	2.66	.92	7.69	5.89	6.16	8.30	7.82	10.81	4.82	75.82
Sans Souci ..	10.70	1.92	1.11	1.52	.30	4.86	6.81	5.42	8.95	13.88	13.11	3.99	72.57
Orange Hill ..	11.04	1.51	1.24	3.05	.63	3.81	4.50	6.08	7.08	9.19	17.18	4.44	69.75
Glen ..	16.01	2.76	.78	3.09	1.22	6.06	4.83	4.22	6.38	10.15	8.75	5.08	69.23
Experiment Station ..	14.81	2.76	1.12	2.25	1.18	6.66	5.30	4.61	8.34	6.19	10.49	4.54	68.25
Brighton ..	10.15	1.29	.87	1.81	.64	4.40	3.45	4.82	5.01	9.94	9.63	3.66	55.67
Bequia ..	9.28	1.21	1.06	2.47	.05	5.39	4.71	4.33	3.32	9.05	9.29	5.46	55.62
Barrouallie ..	7.69	.58	.65	1.10	.42	4.90	4.85	5.01	6.63	4.65	5.95	1.87	44.30
Union Island ..	10.78	.70	.85	1.10	.15	3.30	2.58	3.70	3.80	3.00	7.35	3.40	40.71
Canouan ..	10.98	1.07	1.38	1.11	1.18	1.71	3.52	2.16	3.69	3.24	8.17	2.40	39.58
Mayreau ..	6.96	1.08	.69	.65	.24	1.58	1.96	1.19	3.19	.92	6.36	2.35	27.17
Botanic Gardens average rainfall 44 years.	6.50	4.11	3.89	3.93	6.63	10.81	11.69	11.58	11.08	11.90	11.47	7.77	101.36

Rain was recorded on 252 days at the Botanic Station during the year and on 231 days at the Experiment Station.

Table XXIII gives the mean temperature, degree of humidity and barometric pressure at the Experiment Station for each month of the year. Observations were made twice per day at 9 a.m. and at 3 p.m.

TABLE XXIII.

Months.	*Mean temperature.*	*Average degree of humidity saturation* 100.	*Mean Barometric pressure in inches.*
January	78.97	74.3	29.920
February	79.8	71.0	29.964
March	80.7	72.6	29.943
April	81.7	74.3	29.933
May	82.5	78.7	29.924
June	82.1	74.5	29.961
July	83.1	73.5	29.961
August	84.5	72.3	29.921
September	85.2	71.4	29.935
October	85.2	70.2	29.910
November	83.5	73.8	29.831
December	82.5	70.6	29.877

The readings of the barometer, corrected for instrumental error, elevation, temperature and latitude ranged from 30.063 on 12th April to 29.764 on 4th December.

APPENDIX II.

Three Rivers Land Settlement.

The Three Rivers Land Settlement was initiated in May, 1933, when 132 allotments, totalling 631 acres, were available for distribution. By April, 1934, approximately 338 acres had been taken up but thereafter sales were slow and to encourage applicants Government reduced the initial payment from 20% to 10% of the total purchase price. This action had the desired effect and by the end of 1934, all but 17 allotments, or 99 acres were sold. In 1935, 10 allotments with an area of 50 acres were sold, in 1936 a further three, and at the end of 1937 only one remained unsold.

It was soon found, however, that the allottees were in arrears with their instalments. The payment of relatively large annual instalments immediately after paying 20% or 10% of the purchase price proved rather a severe strain on the financial resources of the settlers and in many cases either forced them into the hands of money-lenders or resulted in defaulting on their annual payments or both. In an effort to aid in this direction Government in 1935 extended the period of payment from 10 to 20 years, but as this involved the signing of a new agreement, the allottees were suspicious and have been slow to take advantage of the new arrangement, only twenty-one having so far signed the new agreement.

As a further aid in the financing of the settlers an Agricultural Credit Society was formed in 1934 and received a loan of

£300 from Government in that year. This was repaid in 1935 and a further loan of £130 was granted in 1936 and this was repaid in 1937-38. The money is loaned to the Society by Government at 4% per annum and the Society in turn lends money to its members at 6%. The arrangement has worked fairly satisfactorily but owing to a certain lack of discrimination on the part of the Committee of Management of the Society, loans have been made to certain members from whom it has been rather troublesome to collect the amounts. It is hoped, however, that with increasing experience, prospective borrowers will be subjected to closer scrutiny and greater caution displayed in the granting of loans.

One of the most effective measures taken by Government for aiding the settlers has been the leasing of the Three Rivers Arrowroot and Syrup Works to the Credit Society at a peppercorn rental for the use of members of the Society. Members are thereby enabled to extract starch or manufacture syrup at a much lower cost than would be otherwise possible and there is no doubt that the settlers have benefited very materially. The Works are in a rather dilapidated condition, however, and the quality of the products is not always what may be desired; the profits of the working of the Society are being used to effect minor repairs and replacement but the funds of the Society are inadequate to effect the rather complete renovation and repairs required.

The settlers in general take a very keen interest in their holdings and, in spite of the financial strain of early years, are making steady, though perhaps slow progress. The Three Rivers lands are rather coarsely gravelly and consequently may easily lose their fertility unless carefully managed. The settlers very quickly realised the need for manuring such soils and are for the most part endeavouring to purchase animals in order that a supply of pen-manure may be made available, progress in this direction is somewhat hampered, however, by the fact that a number of the allottees own land elsewhere and do not live on their holdings at Three Rivers.

APPENDIX III.

Agricultural Credit Societies.

Three Rivers. The fees collected by this Society during the 1937 crop for the manufacture of syrup and starch at the Three Rivers Works amounted to £131. 11. 7 and £144. 12. 6 were disbursed to cover working expenses and to effect repairs to the buildings and equipment.

In November, 1936, the Society obtained a loan of £130 from Government at 4% interest and this was advanced to members at 6%. Owing to a number of reasons the loan from Government could not be granted as soon as the application was received and consequently the money was made available too late for certain members and advances were postponed for four or five months. In effect, these members had been granted loans for a period of only seven or eight months when the repayment of the loan to Government was due, and Government, therefore, decided to grant an extension to March 1938 for the repayment.

The working of the Society was not altogether satisfactory in 1936-37 and it would now appear that greater control of this Society than is provided under the Agricultural Credit Societies Ordinance is desirable.

Clare Valley-Questelles.— Of the new loan of £72. 18. 4 granted to the Society by a private individual £59. 14. 4½ had been repaid by 30th June, 1937. Some effort has been made to collect long outstanding loans and by June 1937, the outstanding amount of £86. 9. 8 had been reduced by £35. 11. 10 of which £35. 3. 9 were loans granted previous to 1935.

Georgetown. The activities of this Society were limited by lack of funds. As usual the amount of £20. 16. 8 was repaid and the same amount redistributed to the same members.

APPENDIX IV.

Report on the Working of the Government Cotton Ginnery for the period, 1st January to 31st December, 1937.

Reorganisation of Staff.

It was found necessary to reorganise the staff at the Ginnery as from 1st January, 1937. The staff for the year consisted of:—

(a) Manager.
(b) Senior Overseer and Cotton Purchaser.
(c) Assistant Overseer.
(d) Junior Overseer.
(e) Mechanic.
(f) Pay Officer (Temporary).

Ginning and Baling.

More seed-cotton was ginned during the 1936-37 crop than in 1935-36. As compared with 845,907 lb. of Sea Island Cotton (765,903 lb. white and 80,004 lb. of stained) ginned during the 1935-36 crop, 969,763 lb. (845,082 lb. of white and 124,681 lb. of stained) were ginned for the 1936-37 crop.

The lint obtained in 1935-36 was 192,689 lb. of white and 26,606 lb. of stained and in the 1936-37 crop 206,817 lb. of white and 28,721 lb. of stained.

The Co-operative Cotton Purchase System.

The advances paid on seed cotton were increased from the 6 cents per lb. paid on white seed cotton during the 1935-36 crop to 6½ cents per lb. for the 1936-37 crop and from 1½ cents to 2 cents per lb. in the case of stained seed-cotton. 386,664 lb. of white and 59,194 lb. of stained seed-cotton were purchased

The lint obtained amounted to 94,368 lb. of white and 13,249 lb. of stained.

A bonus of 43.33% of the advance was paid. The total sum of money paid out in advances and bonus amounted to £8,019.

Oil Expressing and Refining.

The 1,191,414 lb. of prime cotton seed expressed yielded 16,155 gallons of crude cotton seed oil and 460 tons of prime cotton seed meal.

13,596 gallons of refined cotton seed oil and 4,051 bars of soap were manufactured.

Other Operations.

(a) Great care was taken with the selection and disinfection of cotton seed reserved for planting purposes. A greater quantity of this seed was sold in 1937 (48,541 lb.) than in 1936 (37,949 lb.) or 1935 (26,147 lb.).

(b) Stained seed amounting to 189,935 lb. was disintegrated into manure.

(c) 7,592 lb. of corn were ground into meal or stock-feed.

(d) 1,310 lb. of corn were fumigated and stored.

Mechanical and Constructional Improvement.

1. The buildings were wired so that electric current for lighting may be obtained from the city mains.

2. The new baling press and the electrically driven hydraulic pump (fitted to operate both old and new presses) were first brought into use in 1937.

3. Mesh-wire grids were fitted to the bases of the gin-trays so that foreign matter should pass through and out of the lint.

4. A new cylinder head was affixed to the engine used to drive the gins, a screen erected around the delinter and guards placed on all belts in the engine room. One of the Anderson expellers which had been running with incorrect adjustment given the proper setting.

5. Another 4,000 gallon tank for storing crude cotton seed oil was erected in order to eliminate the storage of oil in unsuitable containers.

6. The refinery was thoroughly cleaned and the floor plastered. Two pipe lines, one from the crude storage into the refinery and another from the refinery into the refined storage, with the necessary pumps were installed to reduce handling.

7. Repairs to the sills, plates and sides of the main building and two of the warehouses were carried out, the walls of the running floor were painted and the walls of the engine-room washed.

8. Modern sanitary arrangements were installed in an annexe to the office building.

9. The trolley line was reconstructed on a concrete base.

10. A very substantial store-house for protecting the seed selected for planting purposes was erected by the Public Works Department. This building has been designed to be storm and fire-proof and may be made air-tight for fumigation.

A summary of operations showing comparative figures for the Crops 1934-35, 1935-36 and 1936-37 is given hereunder:—

		1934-35.	1935-36.	1936-37.
Seed-cotton received and ginned	lb.	324,155	845,907	969,763
Seed-cotton purchased	lb.	193,391	420,487	445,858
Cotton seed expressed	lb.	514,890	1,158,710	1,191,414
Cotton seed disintegrated	lb.	43,014	114,885	189,935
Cotton seed oil refined	galls.	3,073	13,354	13,596
Cotton seed meal ground	tons.	176	313	460
Soap manufactured	bars.	1,777	2,802	4,051
Cotton seed selected and disinfected for planting	lb.	26,147	37,949	48,541
Corn ground	lb.	5,501	8,834	7,592
Grain fumigated and stored	lb.	19,268	16,593	1,310
Corn shelled	lb.	23,508	9,093	Nil.